

numerous. Upper parts black, with the neck and a short stripe in the middle of the back white; another white curved band on each side of the back. A more or less distinct black stripe along the middle of the abdomen.

In one specimen the white colour is replaced by pink.

Several adult and young examples from Fienerentova. Length 7 inches.

XIX.—*Notes Introductory to the Study and Classification of the SPONGIDA.* By H. J. CARTER, F.R.S. &c.

[Continued from p. 40.]

Part II. PROPOSED CLASSIFICATION OF THE SPONGIDA.

IN the general classification of the Spongida there is not much difficulty, as the skeleton (which too often is the only part that reaches us, from the inaccessible places in which many of them grow and the accidental circumstances under which they reach the shore) consists of durable material which, in structure and composition, admits of very easy arrangement; while where there is no skeleton at all, this alone for such sponges is sufficiently characteristic of the order.

But in the more particular classification there are peculiar difficulties, inasmuch as there is no expression in sponges as in other animals and in plants; that is, there is nothing like a *calice*, as in the coral, and nothing like a *flower*, as in the plant, to guide us—what there is in this respect, viz. the *spongozoon*, being microscopic in size, undistinguishably alike and so protean in form as only in its *active* living state *in situ*, or just after it has been eliminated from the sponge, distinguishable from a common amœban animal.

Again, as regards the general form of the sponge itself, there are many instances where the same form may be assumed by totally different species, and the same species assume different forms, so that a microscopical examination of the “proper spicule” can alone determine the species; thus a fan-shaped and a vase-like form respectively may have at one time the same, and at another a different form of spicule. And yet again the aid derived from the form of the “proper spicule” is confined to sponges so provided, while those which have nothing but foreign objects instead of the “proper spicule” are even

without this aid. So that, after all, we may be thrown back upon structural peculiarities in combination with general form, and perhaps sometimes colour, for ultimate distinction. (This will be found to be particularly the case with the *Hircinida*.)

Still there are many instances where the same species may be hastily recognized by its outward features; but as this can only be done after much experience, it is of no use to a beginner. At the same time, from what has been above stated, it would always remain uncertain, even to the experienced, without a microscopical examination.

A fresh sponge, too, described in its natural state (that is, with the sarcode on) differs greatly from that in which the sarcode is off, or where the skeleton only remains. As, however, by far the greater number of sponges come to us in the latter state, and, indeed, all must be divested of the sarcode before they can be usefully described for classification, seeing that, as before stated, there is no animal expression (so to term it) externally or internally that can be made use of for this purpose, it seems best to describe the skeleton naked, rather than under cover of the sarcode—that is, to describe the skeleton only, although, of course, where this can be done with the sarcode on as well as off it is best of all. But there is no doubt that a description of the sponge with the sarcode on will never serve to recognize its skeleton, which is at once the most characteristic and frequently the only part that we can or are ever likely to obtain from the inaccessible localities in which many grow; so after all we are not so badly off with the skeleton only, provided it has not been worn away by much attrition. Hence the fundamental divisions of my arrangement will be based on the characteristic features presented by the elementary composition of the skeleton or organ of support. It should not be forgotten, however, that with the sarcode of course the flesh-spicules disappear, falling through the skeleton, as before stated, like small pebbles through the meshes of a fishing-net, when the sarcode passes into dissolution. Nor should it be forgotten that there may be a great difference between a sponge in its “fresh” and in its dried state, in size, colour, and general appearance. As the sarcode in all assumes the characters of glue when dry, those which, like the *Carnosa*, are without horny skeleton can only be described when fresh or preserved in some aqueous solution. Also sponges possessing a skeleton sink down in many instances to half their original size by the shrinking up of the sarcode, which, clinging round the skeleton, destroys the original plumpness of the sponge, and

thus alters considerably its general appearance externally as well as the structure internally. Lastly, the colour under drying, as before stated, may fade in part or altogether. Still there are some things in a sponge which are seen better when dry than when fresh.

Such difficulties beset no other classification in natural history. But what is to be expected otherwise, when, in addition to this, the protean character of the sponge, whose transformations are endless in the soft parts, and only approached in number by being stereotyped in the harder ones, is considered? Hence the unsatisfactory and indefinite characters, especially of the families, which will be found in the following classification.

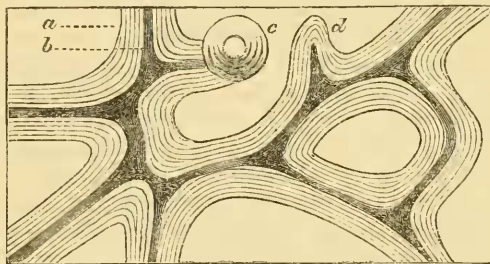
Class SPONGIDA, Huxley.

Order I. CARNOSA.

Without evident skeleton*.

Order II. CERATINA.

Fig. 1.



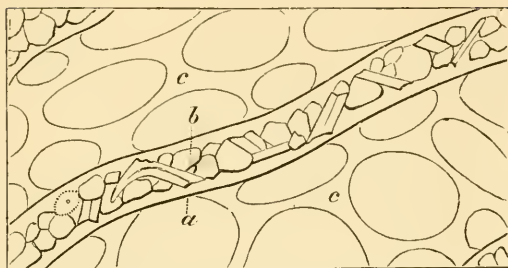
Fibre of Ceratina: *a*, horny fibre; *b*, core; *c*, transverse section of fibre, showing concentric laminar structure around the core; *d*, bud of fibre.

Possessing a skeleton composed of horny fibre with a granular, chiefly hollow, core, containing for the most part no foreign bodies.

* Here and henceforth it should be remembered that the diagnoses respectively refer to the *general characters*. And as regards priority in my Classification, it must be considered quite empirical. But that fibreless spiculeless sponges might pass by gradation into fibrous spiculous ones I have no other grounds to go upon.

Order III. **PSAMMONEMATA.**

Fig. 2.

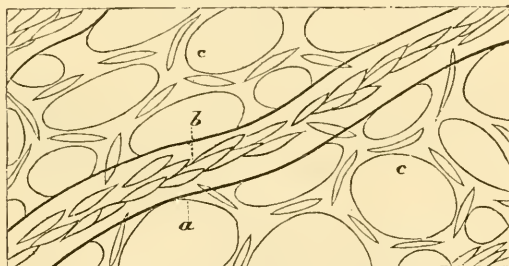


Fibre of *Psammonemata*: *a*, horny sheath of vertical or large fibre;
b, core; *c c*, horizontal, lateral, or small fibre*.

Possessing a skeleton composed of solid fibre more or less cored† with foreign bodies.

Order IV. **RHAPHIDONEMATA.**

Fig. 3.



Fibre of *Rhaphidonemata*: *a*, horny sheath of vertical or large fibre;
b, core; *c c*, horizontal or small fibre.

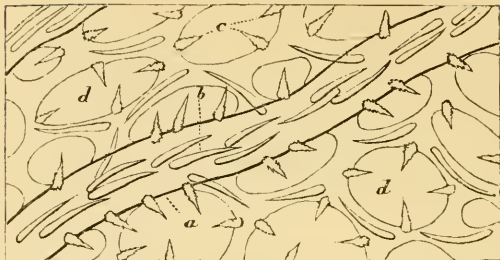
Possessing a skeleton composed of horny fibre with a core of "proper spicules." Form of spicule chiefly simple acerate, and chiefly confined to the interior of the fibre.

* To show that the general outline of the fibrous structure is the same in the Orders 3, 4, 5, and 6, all the figures (viz. 2 to 5 inclusive) will be observed to be alike, differing only in the accessories. Thus by referring to the most simple one, viz. fig. 2, the rest will be easily understood.

† The substantive "core" is here used verbally for brevity.

Order V. **ECHINONEMATA.**

Fig. 4.

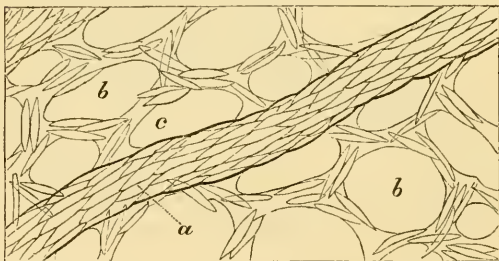


Fibre of Echinonemata : *a*, horny sheath of vertical or large fibre ;
b, core ; *c*, echinating spicules ; *d d*, horizontal or small fibre.

Possessing a skeleton composed of horny fibre cored with proper spicules internally and echinated with proper spicules externally. Form of spicule chiefly acuate.

Order VI. **HOLORHAPHIDOTA.**

Fig. 5.

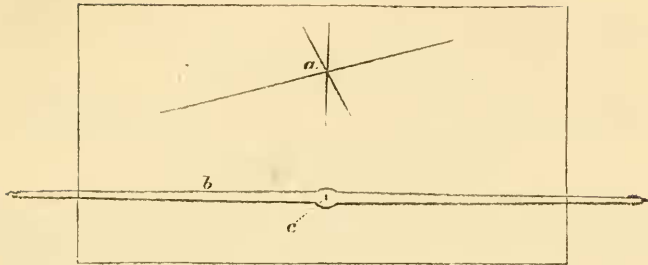


Fibre of Holorhaphidota : *a*, vertical or large spiculo-fibre ; *b b*, horizontal or small spiculo-fibre ; *c*, film of sarcodine accompanying spiculo-fibre.

Possessing a skeleton whose fibre is almost entirely composed of proper spicules bound together by a minimum of sarcodine. Form of spicule variable.

Order VII. **HEXACTINELLIDA.**

Fig. 6.

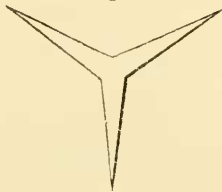


Spicules characteristic of the Hexactinellida: *a*, sexradiate type; *b*, acerate type; *c*, sexradiate cross in the centre.

Possessing a skeleton charged with proper spicules. Spicules all based on a sexradiate type, as indicated by their forms and the presence of a sexradiate cross at the centre of the spicular canal.

Order VIII. **CALCAREA.**

Fig. 7.



Characteristic spicule of the Calcarea.

Possessing calcareous spicules only.

Families.***CARNOSA.**Family 1. **HALISARCIDA.**

Possessing no spicules.

Family 2. **GUMMINIDA.**

Possessing spicules.

* In endeavouring to carry out what I proposed in my "Prefatory Remarks" respecting the classification of the Spongida into "Orders, Suborders, and Families," I find, on arriving at this point, that our knowledge of these beings is not sufficient for doing it further than the eight

CERATINA.

Family 1. LUFFARIDA.

Rigid fibre, with opaque, white, granular core mostly hollow.

Family 2. APLYSINIDA.

Subrigid or flaccid fibre, with wide, hollow, granular core.

Family 3. PSEUDOCERATIDA.

Fibre of either of the foregoing families sparsely cored with foreign bodies—or passing into a dermal layer of foreign bodies, or one of “proper spicules” like that of the Rhabdonemata.

PSAMMONEMATA.

Family 1. BIBULIDA*.

Solid fibre chiefly without core of foreign objects.

Family 2. HIRCINIDA.

Solid fibre chiefly cored with foreign objects.

Family 3. PSEUDOHIRCINIDA.

Solid fibre cored with foreign objects and proper spicules, sometimes also echinated with proper spicules.

RHAPHIDONEMATA.

Family 1. CHALINIDA.

Digitations solid, vertical or procumbent.

Family 2. CAVOCHALINIDA.

Tubular, vasiform, aculeated patulous, or compressed flabellately ; plane and frondose or dactylloid.

Orders with any likelihood of certainty. Hence I now propose to divide them, after these orders, into Families and Groups provisionally, which, on a better acquaintance with the species, might be changed to Suborders and Families as the occasion may require.

Where, however, among the Groups I have to a certain extent been able to anticipate this change, each has been named after a typical genus ; but where no typical species has yet been described, the Group has been named adjectively after its most striking characters.

* This family has been placed among the Psammonemata, because I have never failed in good specimens to find here and there a fibre cored with foreign bodies. But as this is likely to escape observation from its scantiness, I have given the family the character of “simple solid fibre,” although I cannot, from the fact mentioned, make it an order.

Family 3. ACERVOCHALINIDA.

Massive clathrous, or compact and isodictyal.

Family 4. PSEUDOCHALINIDA.

Digitiferous, composed of fibre cored with proper spicules and foreign objects.

ECHINONEMATA.

Family 1. ECTYONIDA.

Echinated with proper spicules *on* the fibre.

Family 2. AXINELLIDA.

Echinated with proper spicules projecting from the *interior* of the fibre.

HOLORHAPHIDOTA.

Family 1. RENIERIDA*.

Spicules more or less arranged in a fibrous form. Structure yielding to pressure like crumb of bread.

Family 2. SUBERITIDA.

Tissue chiefly cork-like ; spicules matted felt-like ; cancellous and crushable, or radiated compact and hard ; spicule chiefly pin-like, with the sharp ends projecting from the surface velvet-like.

Family 3. PACHYTRAGIDA.

More or less corticate, with a cancellous, more or less radiated structure internally well differentiated.

Family 4. PACHASTRELLIDA.

Without cortex ; densely spiculiferous, even to stony hardness (Lithistina). Structure confused ; no fibre.

Family 5. POTAMOSPONGIDA, Gray.

Fragile sponges bearing seed-like bodies or statoblasts, and inhabiting fresh water.

* After Etienne-André Renieri, of 1793.

HEXACTINELLIDA.

Family 1. VITREOHEXACTINELLIDA.

Fibre vitreous spiculiferous.

Family 2. SARCOHEXACTINELLIDA.

Sarcospiculiferous.

Family 3. SARCO-VITREOHEXACTINELLIDA.

Partly fibro-vitreous, partly sarcospiculiferous.

CALCAREA*.

Groups†.

CERATINA.Family 1. *Luffarida*.

Forms only a single group.

Sarcode chiefly purple or dark red-brown throughout, darkest on the surface. Skeleton composed of a uniform reticulation of horny, crisp, rigid, anastomosing transparent fibre, of a bright golden or brown amber-colour‡; cored throughout continuously with an opaque white, granuliferous, mostly tubular membrane, less in diameter than half that of the fibre; terminating by anastomosis just above the level of the surface. Structure reticular. Texture hard, resistant, brittle§. Forms massive, lobed, tubular, single or grouped; or branched dichotomously, branches round, solid.

* For a classification of the Calcareous sponges, together with illustrations, see Hæckel's monograph entitled 'Die Kalkschwämme,' 1872.

† The *characters* of the groups have been deduced from descriptions generally of the genera and species, which will be found in the last part of this communication.

‡ The colour of sponges, as before stated, is for the most part evanescent; it may be general or confined to the dermal sarcode, and here only to those parts which are most exposed to the sun. What has been stated in the Anatomy and Physiology of the Spongida as regards the specific value, not only of colour, but of form, should be here remembered.

§ Texture is not always to be depended on, as resilient or elastic fibre if much bruised may become tow-like or cottony, and stiff fibre, if the specimen has not had all its salt extracted by soaking in fresh water, may, on the least dampness in the air, become flaccid, like glue under similar circumstances. Indeed some sponges, like certain Fungi, expand so much under the influence of damp or moisture, that they appear to be *hygrometric*.

Family 2. **Aplysinida.**

Forms only a single group.

Sarcode colourless, black-purple or madder-brown throughout, darkest on the surface. Skeleton composed of an irregular reticulation of subrigid or flaccid, horny, anastomosing translucent fibre, of a dark amber-colour; cored interruptedly here and there with a granuliferous tubular membrane, much more than half the diameter of the fibre in width, and presenting here and there a fragment or two of foreign objects. Fibre of two kinds, viz. vertical or large, and horizontal* or small fibre, the former terminating on the surface in small points or whip-like filaments. Structure reticular. Texture soft, resilient. Forms incrusting, or massive, or tubular, or flabellate, or foliaceous, sometimes proliferous.

Family 3. **Pseudoceratida.**

Forms only a single group.

Sarcode madder-brown or brownish yellow throughout. Skeleton mostly the same as in the Aplysinida. Vertical fibre terminating on the surface in whip-like filaments among a crust of foreign bodies, or in a dermal reticulation of horny fibre charged with "proper spicules." Structure reticular. Texture resilient and open, or soft and compact. Forms massive, lobed, or rising into a group of tubular digitations.

PSAMMONEMATA†.Family 1. **BIBULIDA.**Group 1. **Euspongiosa.**

Sarcode black, purple, or brown externally, pale amber within. Skeleton composed of a reticulation of solid, horny,

* The term "horizontal" here must be considered equal to "lateral," as the main or vertical fibre often assumes a radiating or plumose form, in which its direction may become horizontal.

† The collection of sponges in the British Museum, which has chiefly served to form the families of this order, came from all parts of the world, where, from their consisting for the most part exclusively of the skeleton, they have apparently been picked up on beaches, having probably, from their great size, originally grown in deep-sea caverns, from which they could not have been obtained in any other way. Hence their mostly unsatisfactory state for this purpose.

The principle in arrangement has been to begin with horny fibre sparingly cored with foreign bodies, then to go to that in which the core is more general, and finally to end with that in which the horny element is scarcely visible, and the core of foreign bodies only held together by a minimum of sarcode, like the spicules in the Holorhaphidota.

The family "Pseudohircinida" has been added for such species of the Psammonemata as have "proper spicules" in addition to the core of foreign objects.

anastomosing, transparent fibre of different shades of pale amber-colour, with no obvious core. Fibre of two kinds, viz. vertical or large and horizontal or small fibre, the former terminating on the surface subpenicillately. Structure vertical or radiating. Texture varying from compact, fine, and woolly to rigid, open, and coarse. Forms incrusting or massive lobed, or hollow tubular or funnel-shaped, branched or foliated.

Group 2. *Paraspongiosa*.

Sarcode the same. Skeleton the same, but with the large fibre terminating on the surface in penicilli cored with minute foreign objects. Structure the same. Texture variable also. Forms incrusting or massive lobed, or hollow vasiform, or massive flattened simply or lobed and branched.

Family 2. *HIRCINIDA*.

Group 3. *Hirciniosa*.

Sarcode brown or pink on the surface, pale internally. Skeleton composed of a reticulation of horny, anastomosing translucent fibre of a pale grey or amber-colour, cored more or less with minute foreign objects. Fibre of two kinds—viz. vertical or large, and horizontal or small fibre; the former terminating on the surface in more or less prominent aculeations, between which the horizontal fibre is stretched in straight lines, so as to present a polygonal appearance. Dermal sarcode enveloping minute foreign objects which, for the most part, following the course of the dermal reticulation cover the “polygonal” interspaces with a white lace-like layer*. General structure vertical or radiating. Texture more or less coarse and open. Forms massive lobed, or hollow vasiform, or flattened, or branched†.

* Where there is a core of foreign objects, it is most prevalent in the vertical or large fibre and least so in the horizontal or small fibre, which, on this account, is for the most part solid and simple—that is, coreless.

† N.B. In this family the sarcode is often replaced by a filamentous alga, which so much resembles it in form and position that Lieberkühn based his family of “*Filifera*” upon its presence (*Archiv f. Anat. u. Phys.* 1859, pl. x. fig. 2). See also good figures of the specimens so affected, under the name of “*Polytheres*” (*Duch. de Fonbressin et Michelotti, “Spongiaires de la Mer Caraïbe,” Natuurk. Verh. Holland. Maat. Wet. te Harlem, vol. xxi. 1864*).

For this alga I have proposed the name of “*Spongiophaga communis*,” on account of having found it in different sponges from all quarters of the world, although chiefly in *Hircinia* (*‘Annals,’* 1871, viii. p. 330). It is often almost impossible to say to which group of the *Hircinida* the species affected by this alga belongs, especially when the alga has entirely replaced the sarcode, and has thus concealed the skeleton.

Group 4. *Callhistia*.

Sarcode brown (and other colours?). Skeleton composed of a uniform reticulation of horny anastomosing transparent fibre of an amber-colour, cored more or less with minute foreign objects. Fibre of two kinds—viz. vertical or large, and horizontal or small; the former terminating on the surface in more or less prominent aculeations, cored with minute foreign objects, while the horizontal for the most part is without them. Structure vertical or radiating. Texture fine, elastic, uniform (in this respect the skeleton of these sponges surpasses all others in beauty and regularity, hence their designation). Forms massive lobed, or hollow funnel- or vase-shaped, or massive flattened simply or in branches.

Group 5. *Penicillata*.

Sarcode dark brown externally, pale amber within. Skeleton composed of a reticulation of more or less rigid, horny, anastomosing transparent fibre of a light or deep amber-colour, cored more or less with minute foreign bodies. Fibre of two kinds—viz. vertical or large, and horizontal or small; the former terminating on the surface in large, prominent, penicillate aculeations. Structure vertical or radiating. Texture more or less rigid, coarse and open. Forms massive, simple or lobed, or flattened and lobed.

Group 6. *Rigida*.

Sarcode? (absent)*. Skeleton composed of a reticulation of coarse, thick, rigid, horny, anastomosing translucent wiry fibre of a dark amber-colour, more or less cored with minute foreign objects. Fibre of two kinds—viz. vertical or large, and horizontal or small; the latter ladder-like. Surface? (too much worn away for description). Structure vertical or radiating. Texture wiry, reticulate, open. Forms hollow, vase-like.

Group 7. *Subrigida*.

Sarcode? (absent.) Skeleton much the same as the last; but fibre less coarse and more resilient, of two kinds—viz. vertical or large, and horizontal or small—more or less cored with foreign objects. Surface? (too much worn away for description.) Structure vertical, radiating plumose. Texture fine, open, resilient, wiry. Forms hollow, with short, hollow, conical tubular branches like buds or offshoots.

* Where there is “?” or the word “absent” it means that the British-Museum specimens, from which this classification has chiefly been made, are deficient. Nearly all the specimens are dry; so that where the sarcode is present it is for the most part described under this aspect.

Group 8. **Foliata.**

Sarcode ? (absent.) Skeleton composed of a dense reticulation of short-jointed, small, horny, anastomosing translucent fibre of a brown or yellowish tawny colour, cored more or less with minute foreign objects. Fibre of two kinds—viz. vertical or large, and horizontal or small; the former terminating at the surface in small cored aculeations which are closely approximated. Structure vertical, radiating or plumose. Texture firm, dense, tough, fine. Forms digitate; digitations laterally united and flattened, proliferous, foliate.

Group 9. **Dactylifera.**

Sarcode ? (absent.) Skeleton, fibre, structure, and texture the same as the foregoing. Forms digitate; digitations simple or branched.

Group 10. **Fenestrata.**

Sarcode ? (absent.) Skeleton, fibre, structure, and texture the same as the foregoing. Forms hollow and clathrous, or massive lobed, or branched and fenestrate.

Group 11. **Platyfibra.**

Sarcode ? (absent.) Skeleton composed of a reticulation of flaccid, flattened, horny, anastomosing translucent fibre, of a light or brown colour, cored more or less with minute foreign objects. Fibre of two kinds—viz. vertical or large, and horizontal or small; the latter arranged ladder-like between the former, flattened and expanded, so as to present a clathrous structure formed of circular holes of different sizes. Surface ? (too much worn away for description.) Structure vertical, radiating. Texture loose, flaccid, shreddy. Forms massive lobed or branched simply, or simply flattened.

Group 12. **Peraxiata.**

Sarcode ? (absent.) Skeleton composed of a reticulation of horny, anastomosing opaque fibre of a light grey colour, cored throughout with minute foreign objects. Fibre of two kinds—viz. vertical or large, and horizontal or small. Surface ? (too much worn away for description.) Structure vertical, radiating, plumose. Texture firm, rather compact. Forms branched, lobed, and flattened.

Group 13. **Incrustata.**

Sarcode? (absent.) Skeleton composed of a reticulation of horny anastomosing fibre, cored with minute foreign objects and incrustated with the same. Fibre of two kinds—viz. vertical or large, and horizontal or small. Surface? (worn away.) Structure vertical, radiating, or plumose. Texture open, resilient. Forms massive and lobed, or flat and palmate.

Group 14. **Otahitica.**

Sarcode colourless, yellowish, or purple throughout. Skeleton composed of a reticulation of horny, short-jointed, anastomosing fibre, colourless, pale yellow, or purple; more or less covered with minute foreign objects, chiefly towards the surface. Fibre of two kinds—viz. vertical or large, and horizontal or small; the former chiefly cored towards the surface, where, by anastomosing with the latter, it ends in a minutely reticulated and granulated even plane, more or less divided by furrowed reticulation. Structure vertical reticulate. Texture more or less hard and compact. Forms incrusting, massive lobed, branched lobed anastomosing, branches round or compressed; or flattened generally, open and flabelliform or closed and vasi-form; leafy, exfoliate or proliferous*.

Group 15. **Sarcocornea.**

Sarcode? (absent.) Skeleton composed of a reticulation of sarcocornean or sub-horny anastomosing fibre of a pale yellow colour, more or less cored with minute foreign objects. Fibre of two kinds—viz. vertical or large, and horizontal or small; the former terminating on the surface in subaculeations, which are united by reticulation into meandriniform ridges or polygonal subdivisions presenting a uniform even character. Structure reticulate. Texture firm, compact. Forms massive lobed.

Group 16. **Arenosa.**

Sarcode colourless throughout or purplish on the surface. Skeleton composed of minute foreign objects, formed by the aid of a thin film of sarcode into a fibrous reticulation, of a pale

* N.B. This group, based upon Ellis's *Spongia othaitica*, may afford forms in which a core of foreign bodies in the fibre seems to be entirely absent, as in Esper's *Sp. papyracea*, Taf. 65, = *Spongionella Holdsworthii*, Bk. (Proc. Zool. Soc. 1873, pl. v.), thus bearing the same relation to the typical structure of *Sp. othaitica* that the Bibulida bear to "Hircinida;" while among the Cavochoalinida we have still another similarly flattened form where the horny fibre is cored with "proper spicules."

yellow or light grey colour. Fibre thus formed of two kinds—viz. vertical or large, and horizontal or small; terminating externally in a more or less minutely reticulated even surface. Structure vertical. Texture compact, more or less fragile. Forms massive, lobed.

Family 3. PSEUDOHIRCINIDA.

Group 17. Pseudoarenosa.

Sarcode the same as in the foregoing group. Skeleton also composed in the same way, but with the addition of “proper spicules” to the foreign objects. Fibre, structure, texture, and form as in the foregoing.

Group 18. Chalinohircinina.

Sarcode? (absent.) Skeleton composed of a reticulation of horny, anastomosing, transparent fibre of a light or dark amber-colour, cored with a mixture of minute foreign objects and “proper spicules.” Fibre of two kinds—viz. vertical or large, and horizontal or small; the latter chiefly cored with the “proper spicules.” Surface? (worn off.) Structure vertical, radiating, or plumose. Texture open, resilient, easily compressed. Forms massive, lobed or branched, or flat*.

Group 19. Armatohircinina.

Sarcode? (absent.) Skeleton the same as in the foregoing group, but with the fibre echinated also with “proper spicules.” Fibre, structure, texture, and form the same as in the foregoing.

RAPHIDONEMATA.

Family 1. CHALINIDA.

Group 1. Digitata.

Sarcode pale tawny, pink, or purple throughout. Skeleton composed of a reticulation of anastomosing transparent fibre of a pale yellow colour, more or less cored with “proper spicules.” Fibre of two kinds—viz. vertical or large, and horizontal or small; terminating externally in anastomosis, where it is connected with and covered by a minutely reticu-

* It is questionable whether the family “Pseudochalinida” (at the end of the Raphidonemata) should not come in here. If the presence of foreign objects in the core is to determine this, it should; if the *form*, then it should remain where it is.

lated dermal layer, that gives the surface a smooth or even uniform aspect. Vents well marked, scattered*. Spicules chiefly of one kind, viz. simple acerate, more or less finely pointed, and confined to the *interior* of the fibre. Texture fine, compact, or coarse and open, varying with the size of both spicule and fibre. Forms vertical, branched dichotomously or polytomously, stipitate; branches digitiform, cylindrical, *solid*, terminating in rounded extremities, separate, or united laterally and interruptedly (*i. e.* fenestrately), or united laterally and generally throughout (*i. e.* flabellately), lobed or proliferous.

Group 2. **Palmata.**

The same as the foregoing, but with flattened massive digitations and large scattered vents.

Group 3. **Reptata.**

The same as the foregoing, but procumbent, more or less sessile throughout or at intervals, with large crateriform or well-marked vents.

Group 4. **Spinifera.**

The same as the foregoing, but with the branches more cylindrical, defined, and prickly or aculeate.

Family 2. CAVOCHALINIDA.

Group 5. **Tubulodigitata.**

Similar to "Digitata" and "Reptata," but with the digitations tubulate. (When the vents are prolonged upwards from a reptant solid branch, they become tubular digitations.)

Group 6. **Aculeata.**

Sarcode pale tawny or grey when dry. Skeleton the same as the foregoing. Fibre the same, but growing out from the external surface into more or less prominent aculeations or conical eminences like prickles, sometimes an inch high, linked together here and there by angular ridges which, radiating from their sides, tend to an irregularly polygonal division of the otherwise smooth surface; divisions more or less cup-like,

* "Pores." As these are too small to be seen by the unassisted eye (being generally about a 1000th of an inch in diameter), and always situated in the sarcode tympanizing the interstices of the dermal reticulation, while their smallness for the most part renders them of no specific value, they will be seldom mentioned.

depressed. Structure, spicules, and texture the same as in the foregoing families. Vents on the internal surface of the excavation. Forms hollow, tubular, funnel- or vase-like; single or in groups; or hollow compressed, vase-like or flabelliform; smooth and even internally, but covered externally with aculeations or prominent eminences, as before mentioned.

Group 7. **Subaculeata.**

The same as the foregoing, but with the aculeations much less marked or prominent.

Group 8. **Ciliata.**

The same as the foregoing, but with the excavations tubular, separate or united pandeanpipe-like into a compressed massive form, fringed round the orifices of the tubular excavations.

Group 9. **Bivalvata.**

The same as the foregoing, but with the external surface more or less covered with rugose eminences; the form vase-like, compressed, and thus rendered double flabellate or bivalvate; texture leathery.

Group 10. **Complanata.**

The same as the foregoing, but cup-like, expanded, and without rugæ—that is, smooth on each side; with a leathery texture and, for the most part, papyraceous thinness. Allied *in form* to some of the Otahitica, among the Hircinida (see footnote, p. 139).

Group 11. **Plicata.**

The same as the last, but frond-like, thick, papyraceous, plicated, tending to vasiform, in a large undulating continuous cloth-like sheet. Allied in form to some of the Otahitica.

Family 3. **ACERVOCHALINIDA.**

Group 12. **Solida.**

The same in structure &c. as the foregoing, but massive, lobed, and amorphous.

Group 13. **Clathrata.**

The same in composition, but with a clathrous structure.

Group 14. **Dictyalia.**

The same, but with the horny element of the fibre decreased and the spicular element increased*.

Family 4. **PSEUDOCHALINIDA.**Group 15. **Digitifera.**

The same as "Digitata," but cored with foreign objects, alone or more or less mixed with "proper spicules" (viz. the simple acerate) in the same individual.

Group 16. **Fistulodigitata.**

The same as the foregoing, but tubular.

ECHINONEMATA.Family 1. **ECTYONIDA.**Group 1. **Pluriformia.**

Sarcode pale tawny, or pink, or purple throughout. Skeleton composed of a reticulation of horny, anastomosing, transparent fibre of a pale yellow colour, echinated with proper spicules externally and cored with proper spicules internally. Fibre of two kinds (viz. vertical or large, and horizontal or small), often passing into fenestrated flattened fibre, in which the two kinds become indistinguishable; often terminating on the surface in a reticulated form, whose interstices are more or less filled by tufts of projecting echinating spicules, based upon the surface of the fibre sometimes to such an extent as, by contact, to form a uniform continuous crust. Surface often growing outwards into characteristic projections of a massive tubercular or compressed form, which, interuniting with each other, produce a clathrous structure. Vents for the most part small, numerous, and indistinct, consequent on the number of the excretory canal-systems, of which they are respectively the outlets. Spicules, as before stated, of two kinds, viz. axial and echinating: the latter smaller than the axial spicule, for the most part club-shaped, spinous, having its large end imbedded in the surface of the horny fibre. Axial spicule for the most part different in form from the echinating

* Here it is that the Raphidonemata run into the Holoraphidota, so much so that there is a species of *Reniera* (*fibula*, Sdt.) which at Ceylon is a *Reniera* and at the Cape a *Chalinia*, according to our empirical distinctions of the two orders mentioned.

one; generally a simple acuate. Often accompanied by one or more forms of flesh-spicule. Texture exceedingly and characteristically dense in the axis and stem, diminishing in compactness towards the surface, which, when hirsute, is, in the dried state, often characterized by the presence of stiffened sarcode matting together the long projecting spicules of the surface. Forms massive and lobed, or digitate, branched, stipitate; branches uniting clathrously or continuously, so as respectively to produce globular or compressed flabellate heads; sometimes foliate and proliferous; occasionally hollow, vasiform, or tubular.

Group 2. Plumohalichondrina.

Here there are two forms of axial spicules, viz.:—1, simple acuate, smooth or spined; 2, more or less pointed or inflated at the ends, which are often microspined scantily or sparsely. Echinating spicule club-shaped and spined. Flesh-spicule for the most part that termed by Dr. Bowerbank “angulate equianchorate” (that is, with bow-shaped shaft and alæform arms), sometimes accompanied by a bihamate or C-shaped flesh-spicule, sometimes without any flesh-spicule at all. Forms massive, lobo-branched; branches compressed, dichotomous, separate or anastomotic, flabellate proliferous.

Group 3. Microcionina.

Here the chief character is incrusting, spreading, extremely thin, laminiiform, hirsute. Spicules simple acuate (not fusiform), with terminal subspherical inflation more or less spined and fixed scopiformly in the cornified sarcode of the lamina, mixed with or surrounded by smaller forms which are smooth. Echinating spicule club-shaped and spined throughout. Flesh-spicules, a minute navicular equianchorate and a tricurvate in variable quantities respectively. Forms incrusting, thin, laminar.

Group 4. Echinoclathrata.

Structure massive, clathrate, reticulate, with echinated fibre. Echinating spicule acuate, smooth or spined. Forms massive, lobed.

Group 5. Baculifera.

Here the chief characters are the corky nature of the tissue and the peculiar pin-like spicule, whose head is globular or circular compressed, terminal, and applied to the shaft perpendicularly, so as, *en profile*, to resemble the head of a crutch. But there being distinct fibre, and this being echinated as well

as cored by the same form of spicule, induces me to place these sponges among the Ectyonida. Had there been no fibre, but the spicules massed felt-like as in the Suberitida, I should have placed them, from their cork-like nature, among the latter. Forms clathrous, branched, branches verticillately clathrous; mesenteric, or flat round and perfoliate, caulescent; or vasi-form, thin, open and round, or compressed flabellately; stipitate.

AXINELLIDA.

Group 6. Multiformia.

These have all the characters of the Pluriformia, with the exception of the "echinating spicule," which here projects outwards from the core or axial spicules, and not from the surface of the fibre. Moreover both the axial and the sub-echinating spicules are for the most part alike in form, viz. simple acuate; and the former frequently also the largest, instead of the smallest as in the Pluriformia.

Group 7. Durissima.

For want of the sarcode (in which there might have been a flesh-spicule), I do not know where to place these vase-like skeletons, whose structure, composed of coarse, rigid, open reticulated fibre cored with sub-pinlike fusiform acuates, is very like that of an Australian sponge as yet undescribed (whose flesh-spicule and texture very much resembles that of *Axos Cliftoni*, Gray); but the absence of sarcode about these skeletons prevents the identification.

[To be continued.]

MISCELLANEOUS.

On the Occurrence of a Superorbital chain of Bones in the Arboricolæ (Wood-Partridges). By JAMES WOOD-MASON, of Queen's College, Oxford.

IN his elaborate paper "On the Osteology of the Gallinaceous Birds and Tinamous," read before the Linnean Society on November 25th, 1862, Professor W. Kitchen Parker announced the remarkable discovery, in *Tinamus robustus*, "of a whole row of superorbital bones, the like of which must be sought for, not amongst birds, but in a group of creatures a long way down in the scale," viz. in the Skinks and Blindworms. Further on in the same paper, the presence of a

Ann. & Mag. N. Hist. Ser. 4. Vol. xvi. 10